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***SEMPERVIVUM MARMOREUM* GRISEB.
(*CRASSULACEAE*) IN THE UKRAINIAN
CARPATHIANS: DISTRIBUTION,
MORPHOLOGY, COENOTIC
CONDITIONS, POPULATION
PARAMETERS, AND CONSERVATION**

Key words: *Sempervivum marmoreum*, Carpathians,
population, threatened species, conservation

Abstract

A locality of *Sempervivum marmoreum* is reported from the Ukrainian Carpathians. The species has not been reported in the main Ukrainian floristic compendia. It occurs on Kobyla Mt. in the southern part of the Svydovets Range, Rakhiv District, Transcarpathian Region. Exact location and coenotic conditions of the site are presented. Morphological characters of *S. marmoreum* and population parameters are described as well. The population is low-numbered, threatened, occupies only several square meters and needs conservation. The species should be included into the new edition of the Red Data Book of Ukraine as critically endangered (CR).

Introduction

The flora of the Ukrainian Carpathians was studied rather thoroughly since the 19th century, and further floristic surprises in that domain may seem rather improbable. However, new floristic finds made during the last decades [3, 4, 7, 16] prove that this kind of research is very promising in the region. This is especially true for the Transcarpathian Region (Transcarpathia, Zakarpattya) with its peculiar geographical position and natural conditions that provide rich biodiversity of that territory and occurrence of species representing various elements of the flora. Nevertheless, some taxa reported from Transcarpathia by authors of the past have never been verified since then and need confirmation. Because of that further detailed chorological surveys in the region are topical.

The objective of this article is to clarify the status of *Sempervivum marmoreum* Griseb. (*Crassulaceae*), a species originally reported from Transcarpathia by J. Buček in 1932 [12] as «*Sempervivum schlehanii*», but never confirmed later. That species

is listed in S.S. Fodor's «Flora of Transcarpathia» [8] with the reference to the former author. There are also indications in «Flora Europaea» [18] and «Atlas Florae Europaeae» [10] that the species occurs in Ukraine. However, main Ukrainian floristic compendia and identification manuals have no mentions of *S. marmoreum*. We managed to get a proof of the occurrence of that species in the Ukrainian Carpathians, and this article presents the obtained data.

Sempervivum marmoreum (= *S. schlehanii* Schott = *S. assimile* Schott = *S. tectorum* L. subsp. *marmoreum* Maire & Petitmengin) is a species with a Carpathian-Balkan range (Fig. 1). It occurs in Slovakia, Hungary, Romania, Ukraine, Bulgaria, Macedonia, Serbia, Montenegro, Bosnia and Herzegovina, Croatia, Albania, and Greece [1, 2, 10, 14, 15, 17, 18, 20–23]. In the Carpathians its localities occur in all three main parts of these mountains — the Western, Eastern and Southern Carpathians, though the West-Carpathian segment of the range is separated by a considerable hiatus. In that region, i.e. at the northern edge the its range, which reaches the latitude of 48°40' N in Slovakia [23], the species is confined mostly to low elevations, ca. 250–500 m above sea level (a.s.l.). However, in more southward localities, e.g. in Bulgaria, it also inhabits sites in the high-mountain zone up to 2700 m a.s.l. [1]. The main part of the species range lies in the mountains of the Balkan Peninsula [10].



Fig. 1. Distribution of *Sempervivum marmoreum* Griseb.: — locality on Kobyla Mt. In the Ukrainian Carpathians

The localities closest to Ukraine are in Romania in the Marmarosh Depression and the Gutyi, Marmarosh and Rodna Mts. 5–30 km from the Ukrainian border [20].

The species is very variable, especially in leaf color and indumentum, therefore the following subspecies are sometimes distinguished: *S. marmoreum* subsp. *marmoreum*, *S. marmoreum* subsp. *blandum* (Schott) Soó, *S. marmoreum* subsp. *ballsii* (Wale) B.J.M. Zonneveld, *S. marmoreum* subsp. *erythreum* (Velen.) B.J.M. Zonneveld, *S. marmoreum* subsp. *reginae-amaliae* (Heldr. & Sartori ex Boiss.) B.J.M. Zonneveld, *S. marmoreum* subsp. *rubrifolium* (Schott) G.G. Bellia & A. Andrade. However, their taxonomic status is very ambiguous, because variability of that species does not exhibit clear geographical patterns, and numerous intermediates occur throughout the range of *S. marmoreum* [15, 18]. A vast spectrum of varieties, forms and cultivars is sometimes recognized and offered at the market of ornamental plants.

The species is xerophilous and restricted to dry rocks or saxicolous grasslands on the sunny slopes of mountains or hills [1, 2, 14, 15, 18, 23]. It occurs mostly in calciferous (calcareous) habitats in the communities syntaxonically belonging to orders *Seslerietalia albicantis*, *Festucetalia valesiaceae* and *Potentiletalia caulescentis* [9, 14, 21].

In the countries where *S. marmoreum* is rather common it is traditionally used for medicinal purposes [1]. The species is highly ornamental and is sometimes gathered for re-planting in alpine gardens. This presents a real threat to some of its populations. The species is listed in the Red Data Book of Hungary [22] as vulnerable (*VU*). Together with some other species, it is also protected in Greece by Presidential Decree (#67/1981).

Material and Methods

The results presented in this study were obtained during field surveys performed in July, 2005 on Kobyla Mt. in the Svydovets Range.

The exact location of the site was determined with Garmin *eTrex* Global Positioning System (GPS) navigator with the accuracy of measurements within 10 meters.

Population parameters were defined on site, as well as some individual characteristics (height of flowering stems, number of flowers, diameter of rosettes etc.), while the detailed morphological description is based on herbarized specimens and collected live plants.

Several young individuals were transplanted to the Botanical Garden of I. Franko Lviv National University for further observations on their development and for off-site conservation of the species in Ukraine in case of extinction of its natural population.

Species abundance was evaluated according to the grades of J. Braun-Blanquet's scale [11].

One voucher specimen is deposited in the Herbarium of the M.G. Kholodny Institute of Botany (*KW*) in Kyiv.

Results

Location of the site and its coenotic conditions. A small population of *Sempervivum marmoreum* was discovered on the steep south-south-eastern slope of Kobyla Mt. in the southern part of the Svydovets Range, Ukrainian Carpathians (Fig. 1). It is located near the village of Kobyletska Polyana, which belongs to Rakhiv District of Transcarpathian (Zakarpattia) Region. Its geographical coordinates according to the WGS-84 system are as follows: 48°02'03.9"N and 24°05'12.9"E. The site lies on the altitude of 1045 m a. s. l. on the top of a conglomerate rock sticking out from almost undisturbed beech forest. The vegetation in the closest vicinity with the site is represented by *Quercus petraea* (Mattuschka) Liebl., *Sorbus aucuparia* L., *Coryllus avellana* L. in the tree and shrub layers, and *Origanum vulgare* L., *Pimpinella saxifraga* L., *Verbascum lanatum* Schrader, *Luzula luzuloides* (Lam.) Dandy & Wilmott, *Dryopteris expansa* (C. Presl) Fraser-Jenkins & Jermy, and *Iris pseudocyperus* Schur in the herbaceous layer.

Sempervivum marmoreum occurs within the area of about 3 × 1.5 m² on the driest uppermost part of the rock devoid of trees and bushes. Higher plants cover only about 35–40 % of the patch, the rest of which accounts for the lichens, barren soil and eroded outcrops of conglomerate bedrock. The site is unshaded and exposed to the sun during a considerable part of the day. The species composition of vascular plants with corresponding grades of abundance is as follows: *Sempervivum marmoreum* — 1 (covering ca. 4 %), *Poa nemoralis* L. — 1–2, *Festuca* sp. — 1, *Saxifraga paniculata* Mill. — 1, *Asplenium trichomanes* L. — 1, *A. ruta-muraria* L. — +, *Sedum annuum* L. — +, *S. hispanicum* L. — +, *Valeriana angustifolia* Tausch — 1, *Polypodium vulgare* L. — +, *Galium schultesii* Vest. — +, *Campanula carpatica* Jacq. — +, *Sedum fabaria* W.D.J. Koch — +, *Euphorbia cyparissias* L. — +, *Dianthus carthusianorum* L. s. l. — +; and bryophytes: *Rhytidium rugosum* (Hedw.) Kindb. — 2, *Pylaisia polyantha* (Hedw.) Schimp — 1.

Ecological and coenotic conditions in the habitat show that *S. marmoreum* is markedly heliophytous and xerophilous. The soil is moderately acidic with pH(H₂O) about 5.2. The conglomerate bedrock does not contain any significant amount of CaCO₃. Thus, *Sempervivum marmoreum* does not exhibit any special demand for calcium.

Morphological characters. Succulent, evergreen, herbaceous, roseteous, stoloniferous perennial (Fig. 2). Rosettes widely open. Sterile rosettes 25–60 mm, fertile ones (before anthesis) — up to 75 mm in diameter. Rosette leaves fleshy, entire, obovate or oblanceolate, mucronate, shiny, pale green, tinged with red, 25–32 × 8–11 mm in size, puberulent, covered with short, dense, stipitate, glandular hairs on both sides. Cauline leaves alternate, sessile, oblong-lanceolate, acuminate, 25–40 × 5–12 mm, covered with short hairs, more densely on the lower surface. Flowering stem 20–30 cm high, pubescent. Hairs glandular, stipitate, shorter on leaves and at the base of flowering stem and rather long on its upper part and inflorescence.

Inflorescence cymose, with several branches, which elongate considerably and become squarrose at the end of anthesis, bearing 25–35 flowers. Bracts short, narrow-lanceolate. Pedicels 1.5–2.0 mm long. Flowers 11(–12)-merous. Calyx

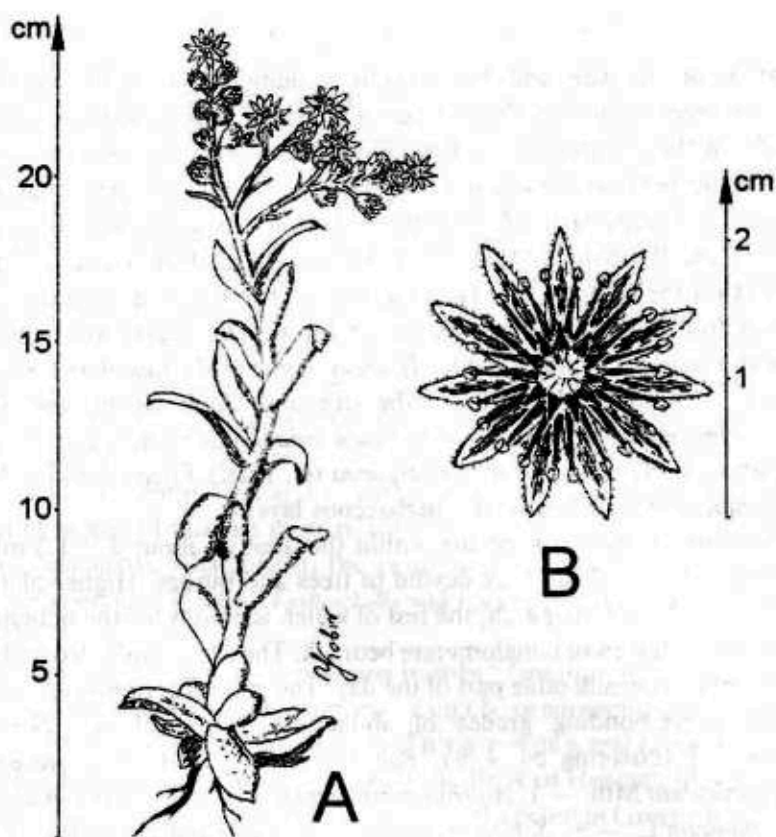


Fig. 2. *Sempervivum marmoratum* Griseb.: A — habit of fertile plant, B — flower

widely campanulate, ca. 5 mm long, divided to 5 of its length, densely covered with long hairs. Calyx teeth triangular. Corolla more than twice as long as calyx, 21–24 mm in diameter. Petals pink, suffused with vinous at the base, with dark, dashed medium part and much lighter margins, linear-lanceolate, acuminate, fimbriate, hairy on the lower surface, ca. 10 mm long and 2 mm wide. Stamens twice as many as petals. Filaments vinous, pubescent at the base, ca. 2 mm shorter than petals. Carpels equal in number to petals, squarrose. Pistils vinous and stigmas whitish in live plants. Seeds numerous, small, ca. 0.8 mm long. The description refers to the individuals from the Svydovets, which may slightly differ from those from other parts of the species range.

Sempervivum marmoratum is closely related to *S. tectorum* L., a species with a more westward range, which occurs in the Pyrenees, Alps, Apennines, and in the mountains of the north-eastern part of the Balkan Peninsula. *Sempervivum tectorum* is much larger — up to 60 cm high, with rosettes 6–10 cm in diameter and inflorescences bearing over 35 flowers. Leaves glabrous on both surfaces, ciliate. Filaments glabrous at the base. This highly ornamental plant became very popular among the gardeners and is widely cultivated all over Europe now, including Ukraine.

Recruitment, phenological development and population parameters. Vegetative spread in *S. marmoreum* is provided via thin (2 mm in diameter) stout stolons up to 7 cm long, on which daughter rosettes develop. They radicate and become autonomous next year after clonal disintegration. Each fertile module bears one flowering stem. It arises on the most vital 2–3-year-old rosette shoots. Fertile modules are monocarpic. At the anthesis in the middle of July the rosette leaves at the base of the flowering stem die off, and during dissemination in August the whole fertile module is already dead.

The described population is low-numbered and contains ca. 20 fertile ramets and nearly 100–120 sterile rosettes, which accounts for about 50 adult individuals. Maintenance is provided mostly by clonal growth but seed reproduction takes place as well, because seedlings occur in the locality. The viability of the population is low and it is prone to decline or even complete extinction caused by natural factors.

Conclusion

Conservation considerations. The Kobyla Mt. population is located at the edge of the species range (Fig. 1). In the Carpathians *Sempervivum marmoreum* is considered as a relict species, a representative of the pre-glacial epoch [9]. Because the tops of mountains and rocks got more insolation, they played a role of refugia where some species could survive during unfavorable oligothermic periods. This is the basic assumption of the so-called «nunatak hypothesis», which suggests that certain species survived even at considerable altitudes during the Pleistocene glaciations in the high mountains of Europe [5, 13, 19]. Similarly, the habitat of *S. marmoreum* on Kobyla Mt. may be very ancient and could probably harbor the species in the Pleistocene. Otherwise, the locality could be colonized later in the Holocene. Anyway, the described population is unique for Ukraine and needs conservation.

No evident signs of human impact have been noticed in the locality. However, because of a very low numbers of the population and extremely limited area available for the species, its survival in the long-term perspective is problematic. The locality seems to undergo gradual natural afforestation with *Fagus sylvatica* in the peripheral zone of the rock and with *Quercus petraea* at its upper part. This causes unfavorable changes in environmental conditions resulting in reduction of the level of insolation and the increase of humidity. Such critical shrinking of the available area suitable for the species may lead to complete extinction of *S. marmoreum* there in a few decades.

In order to ensure the survival of the population some protective activities may be considered, e.g. artificial thinning of trees and bushes around the habitat. This will result in a better insolation and xerophytization of the habitat and could provide more favorable conditions for *S. marmoreum*.

Because the species is represented in Ukraine by a single low-numbered decreasing population, which occupies the area of only several square meters, *S. marmoreum* should be added to the new edition of the Red Data Book of Ukraine and categorized as critically endangered (CR).

As the species represents the Carpathian-Balkan element, its presence in the Ukrainian Carpathians is another proof of numerous floristic links between that territory and the mountains of southeastern Europe [6]. It may be added to the list of other Carpathian-Balkan species, e.g. *Campanula serrata* (Kit.) Hendrych, *Centaurea kotschyana* Heuffel ex Koch, and *Saxifraga carpatica* Sternb.

The Ukrainian name recommended for *Sempervivum marmoreum* is «молодило мармурове».

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**SEMPERVIVUM MARMOREUM GRISEB. (CRASSULACEAE)
В УКРАЇНСЬКИХ КАРПАТАХ: ПОШИРЕННЯ, МОРФОЛОГІЯ,
ЦЕНОТИЧНІ УМОВИ, ПОПУЛЯЦІЙНІ ПАРАМЕТРИ ТА ОХОРОНА**

Повідомляється про оселище *Sempervivum marmoreum* в Українських Карпатах. Цей вид не наводиться в основних українських флористичних зведеннях. Оселище розташоване на г. Кобила у південній частині Свидовецького масиву в Рахівському р-ні Закарпатської обл. Вказані його точне розташування і ценотичні умови. Представлено також морфологічну характеристику *S. marmoreum* і параметри популяції, яка є нечисленною, знаходиться під загрозою, займає площу лише у декілька м² і потребує охорони. Вид слід внести до «Червоної книги України» як критично zagrożений (CR).

Ключові слова: *Sempervivum marmoreum*, Карпати, популяція, вид під загрозою зникнення, охорона

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Сообщается о местопроизрастании *Sempervivum marmoreum* в Украинских Карпатах. Этот вид не приводится в основных украинских флористических сводках. Местопроизрастание находится на г. Кобыла в южной части Свидовецкого массива в Раховском р-не Закарпатской обл. Указываются его точное расположение и ценотические условия. Приведены также морфологическая характеристика *S. marmoreum* и параметры популяции, которая является малочисленной, занимает площадь лишь в несколько м², находится под угрозой исчезновения и нуждается в охране. Вид следует включить в «Красную книгу Украины» как находящийся под критической угрозой (CR).

Ключевые слова: *Sempervivum marmoreum*, Карпаты, популяция, исчезающий вид, охрана